

Battery energy storage systems

The case of Bulgaria: recent policy developments and market dynamics



Bozhil Kondev
18 December 2024

Presentation outline

Bulgaria's power sector

RE drivers

Energy storage in Bulgaria

Policy framework related to BESS

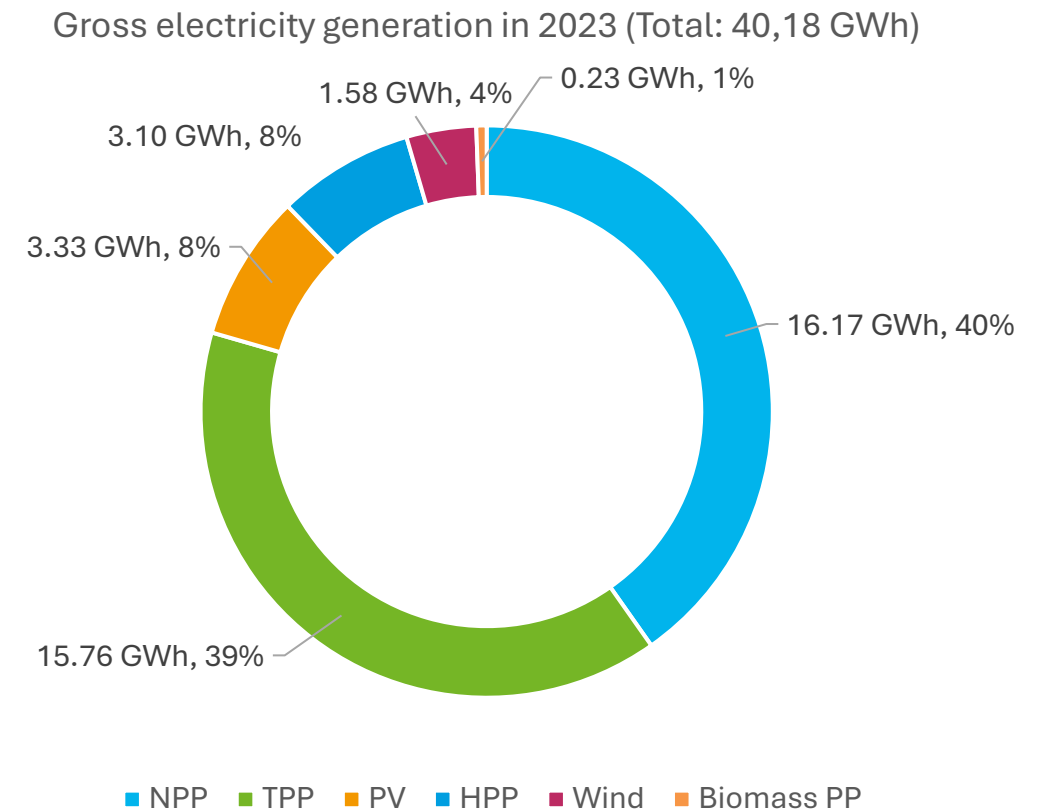
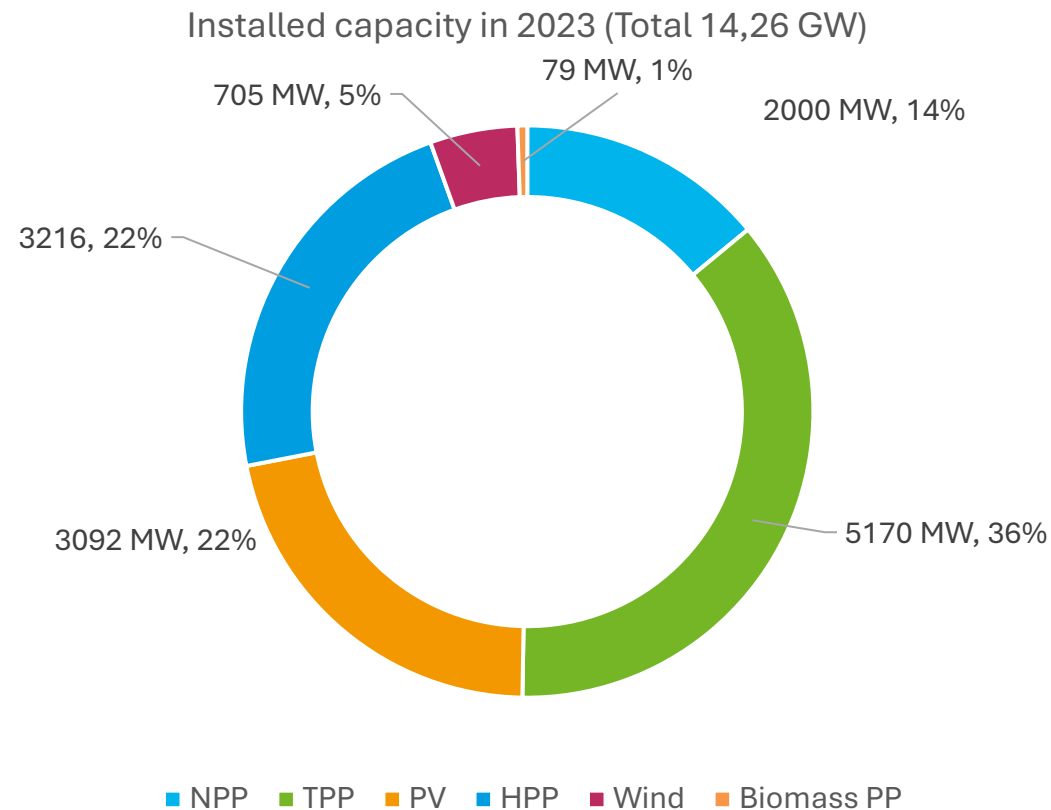
Incentive schemes for BESS

Market development and existing BESS projects

Bulgaria's power sector

Generation	TSO	DSOs	Regulator
			
Retailers	Wholesale Traders	Associations	Power Exchange
			

Installed capacity and power generation in 2023



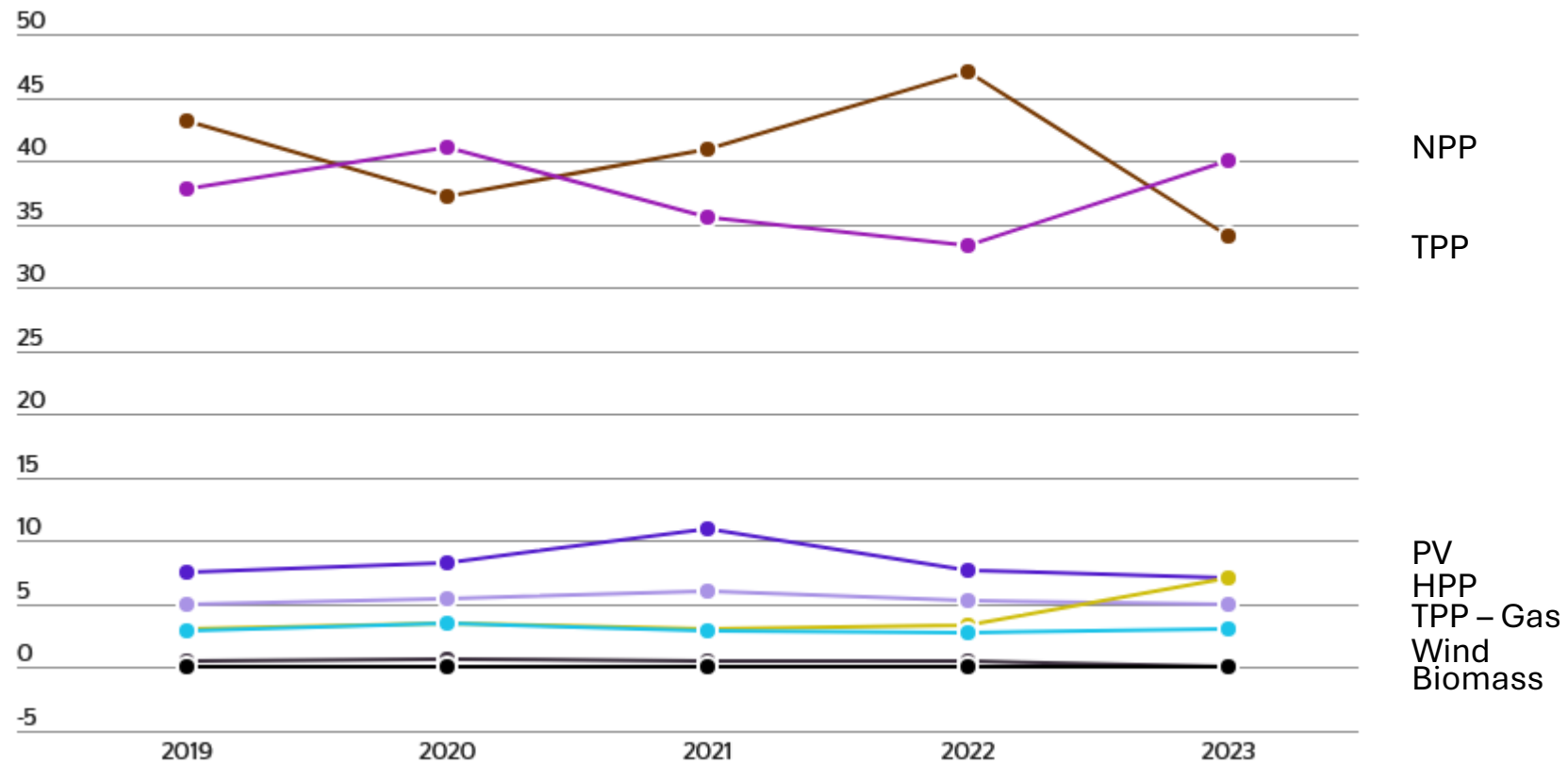
Source: ESO

Interconnections with neighbouring countries



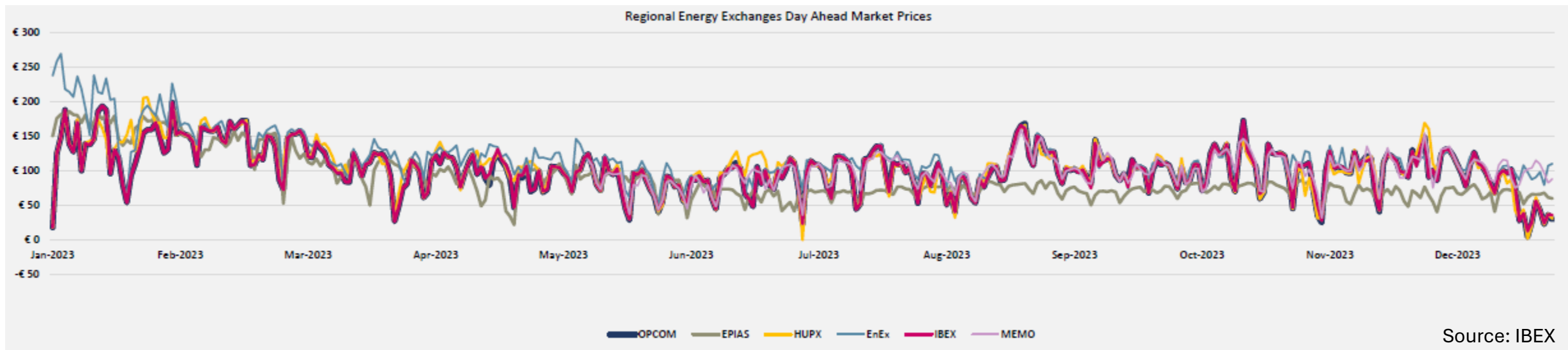
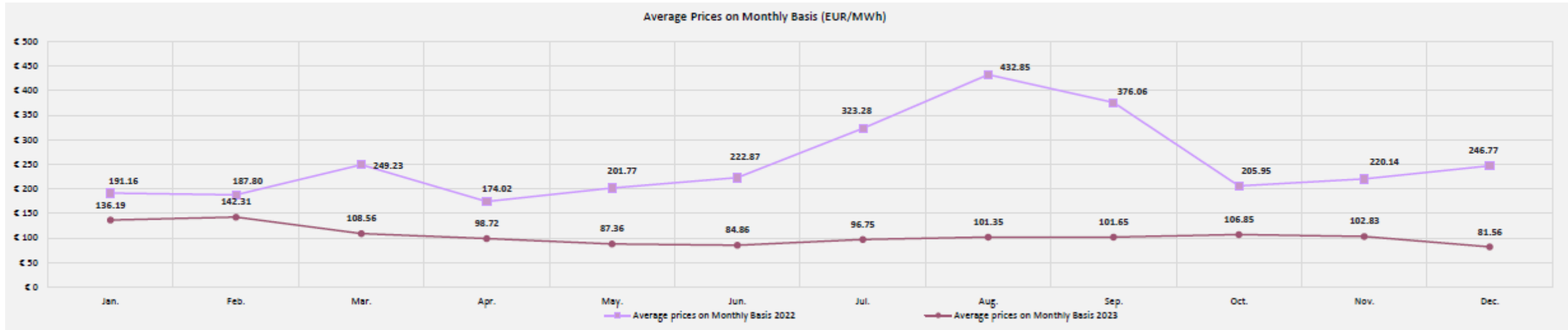
Source: ESO

Contribution to power generation 2019-2023



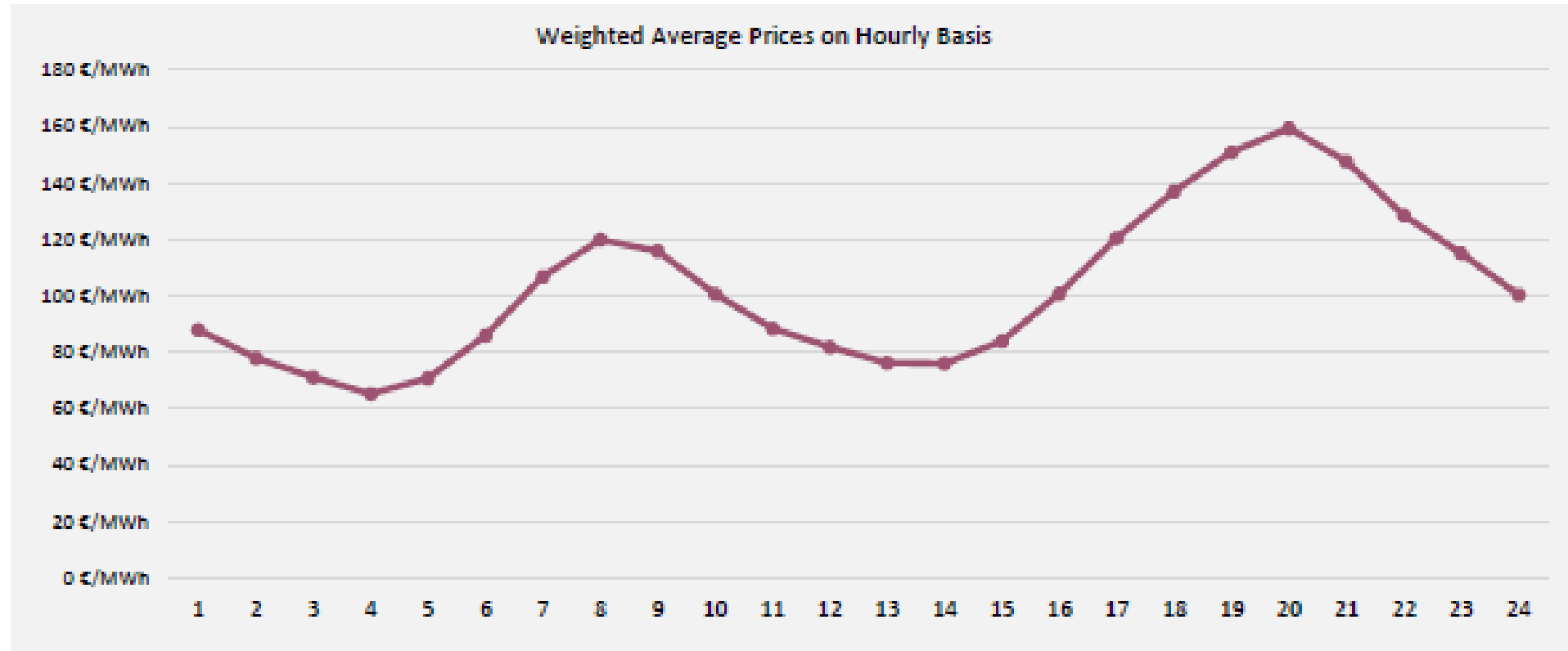
Source: ENTSO-E

RE drivers: Day-ahead prices



Source: IBEX

RE drivers: Intraday prices



Source: IBEX

RE drivers: ESG

Eurohold signs PPA to power Billa Bulgaria with green energy

Oct 10, 2023, 2:24:19 PM | Article by [Plamena Tisheva](#)



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an holding company Eurohold Bulgaria (BUL:EUBG), said Tuesday it has



First 12-year PPA for Green Energy in Bulgaria Enery and KCM AD

June 26, 2023

On June 26, 2023 KCM AD, the leading producer of lead and zinc in Southeastern Europe, has signed a power purchase agreement with a renewable energy developer. **for a period of 12 years starting from 2024.** KCM AD is an energy-intensive company w



SEARCH



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A1 Bulgaria signs solar PPA with Renalfa



Yettel, Cetin Bulgaria sign 10-year solar PPA with Electrohold

Mar 15, 2023, 4:29:50 PM | Article by [Antonia Kokalova-Gray](#)



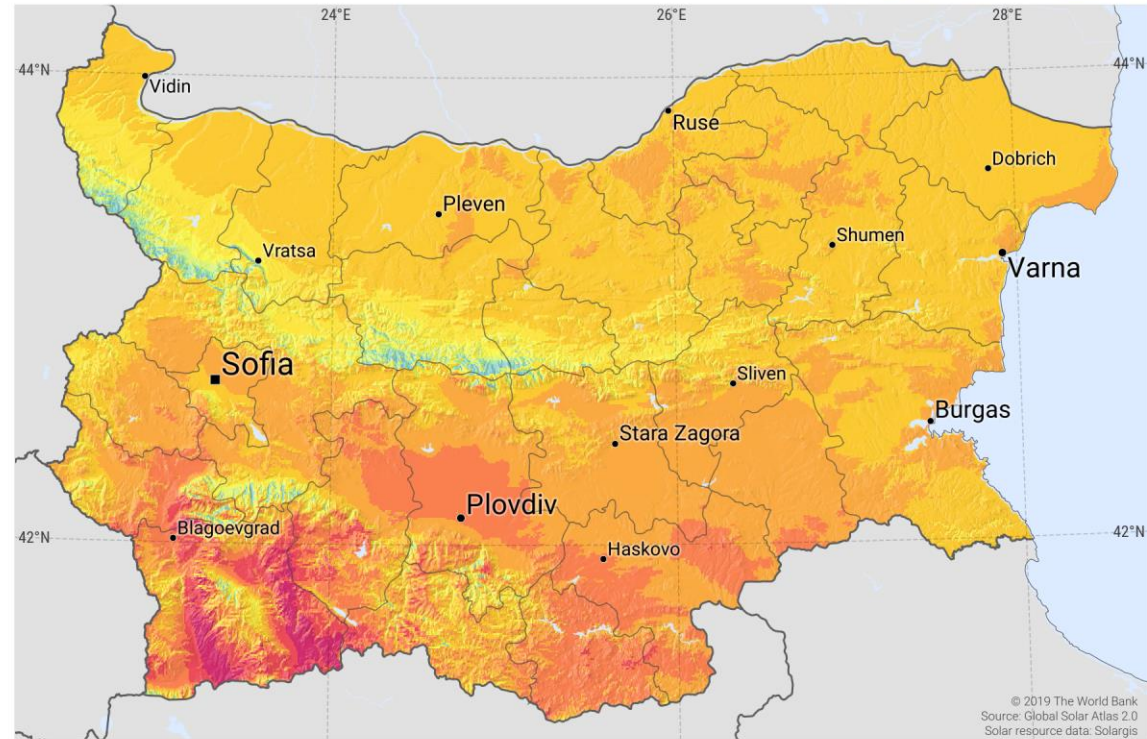
March 15 (SeeNews) – Bulgarian mobile phone operator Yettel and telecoms infrastructure provider Cetin Bulgaria have signed a 10-year power purchase agreement (PPA) with Electrohold, the energy arm of Eurohold Bulgaria [BUL:EUBG], the parties to the deal said on Wednesday.

Sources: SEENews, Balkan Green Energy News, RE-Source, Renewables Now

RE drivers: RE potential

SOLAR RESOURCE MAP

PHOTOVOLTAIC POWER POTENTIAL BULGARIA



Long term average of PVOUT, period 1994-2018

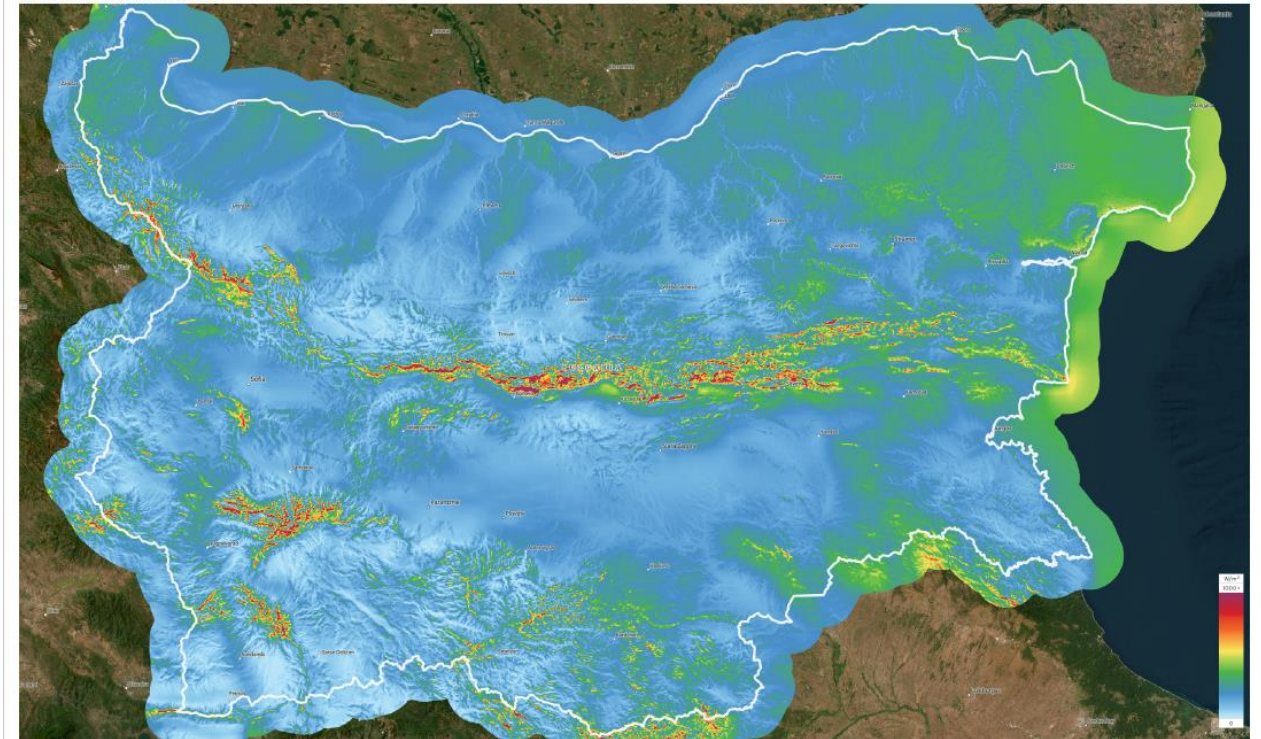
Daily totals: 3.2 3.4 3.6 3.8 4.0

Yearly totals: 1168 1241 1314 1387 1461

kWh/kWp

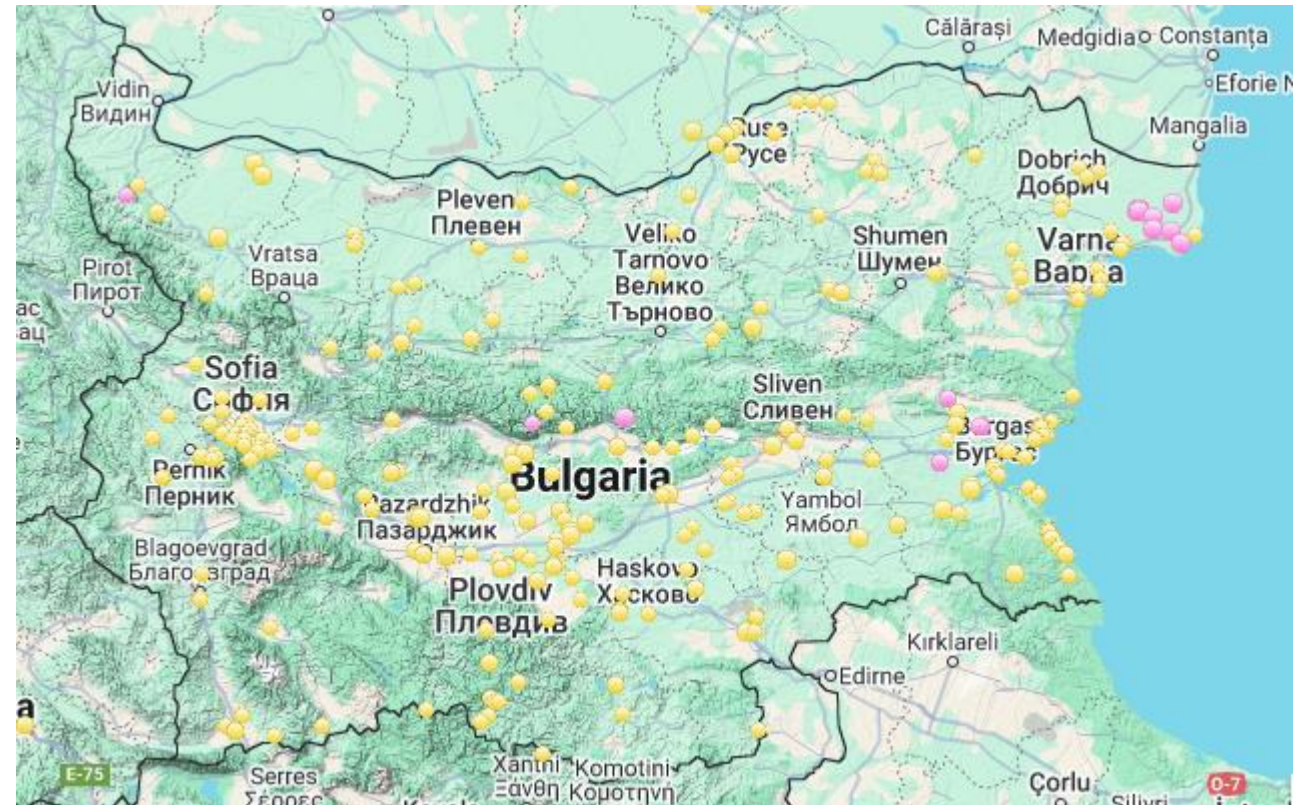
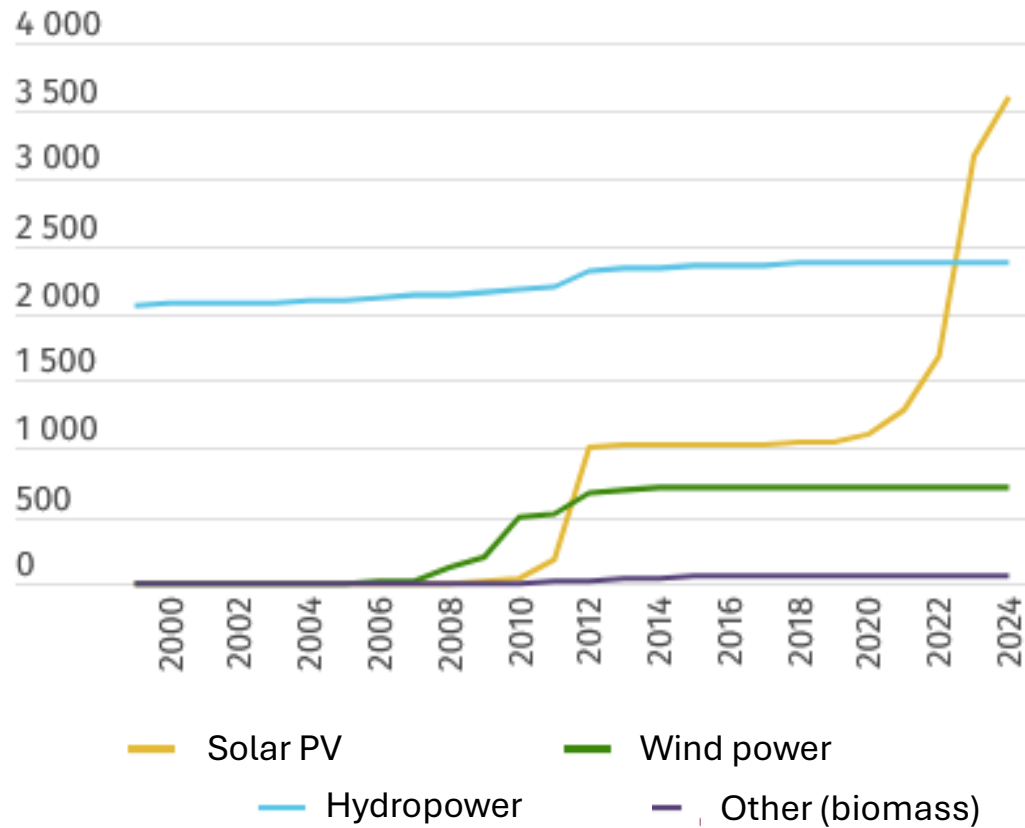
This map is published by the World Bank Group, funded by ESMAP, and prepared by Solargis. For more information and terms of use, please visit <http://globalsolaratlas.info>.

GLOBAL WIND ATLAS MEAN WIND POWER DENSITY AT 100m BULGARIA WIND MAP



Images: ESMAP

RE Installations 2000- H1 2024



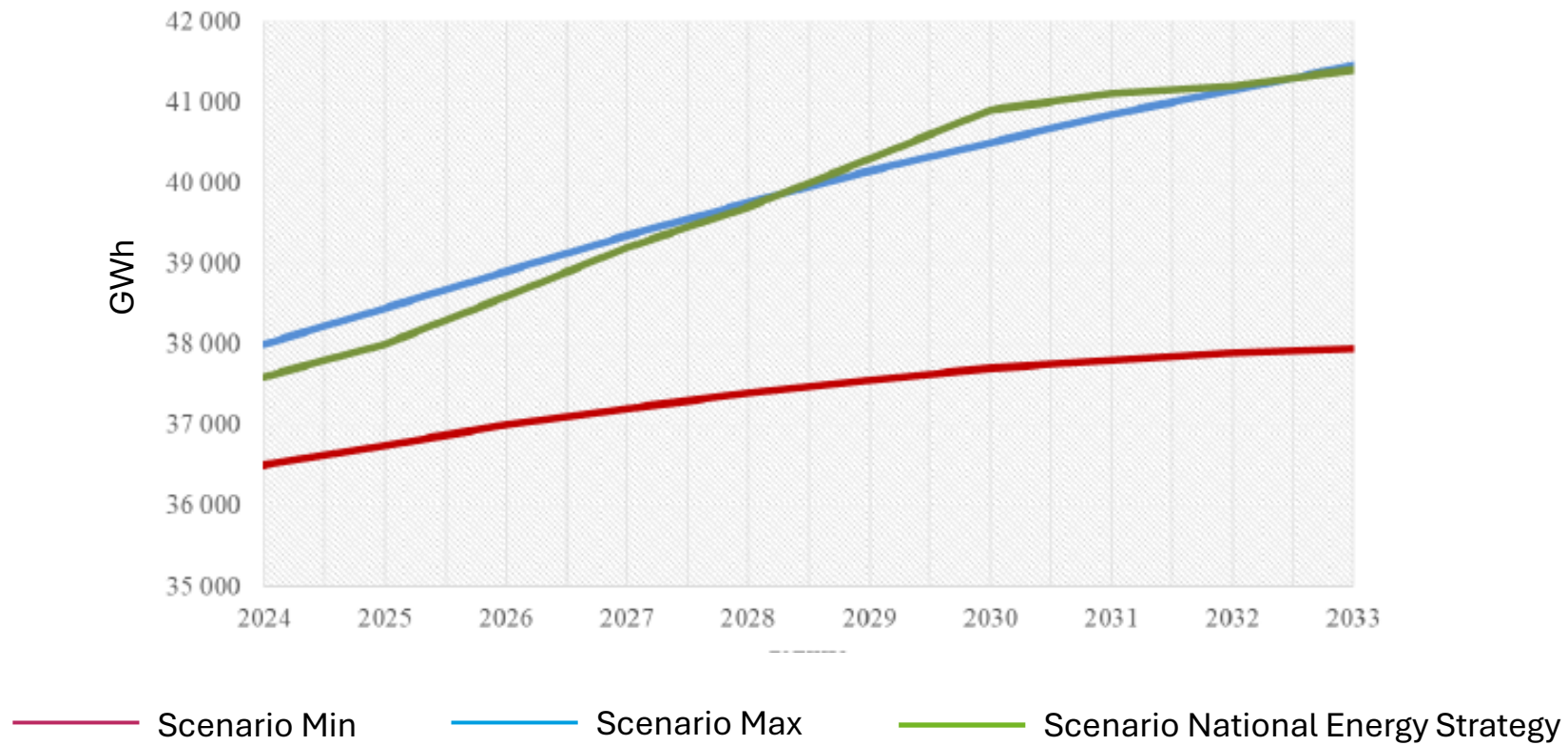
Sources: Capital, Repowermap.org

Solar PV Parks over 100 MW

Investor	Name of the plant	Location	Installed capacity (grid connected), MW	Date of commissioning	Incentive
Real estates	Apriltsi	Pazardzhik, v. Apriltsi	251.2 (300)	Sep-21	none
Galaxy RE (Sunterra)	Dalgo pole 1, 2, 3	Kaloyanovo	208 (196)	Nov-23	none
Galabovo (Sunterra)	Galabovo	Galabovo	201.4 (150)	Aug-23	none
Belozem Solar Park 3 (Eurohold)	Verila	Dupnitsa	123 (100)	May-23	none
CE Energy Group	Terra Sol	Stara Zagora	111.6 (100)	Jul-23	none
Karlovo Solar	Karlovo	Karlovo	107 (99)	May-23	none
Solar Park Lovech	Lovech	Lovech	106.2 (86.2)	May-23	none

Source: Capital, own research

Demand forecast up to 2033



Source: TYNDP 2024-2033

Expected RE capacity additions

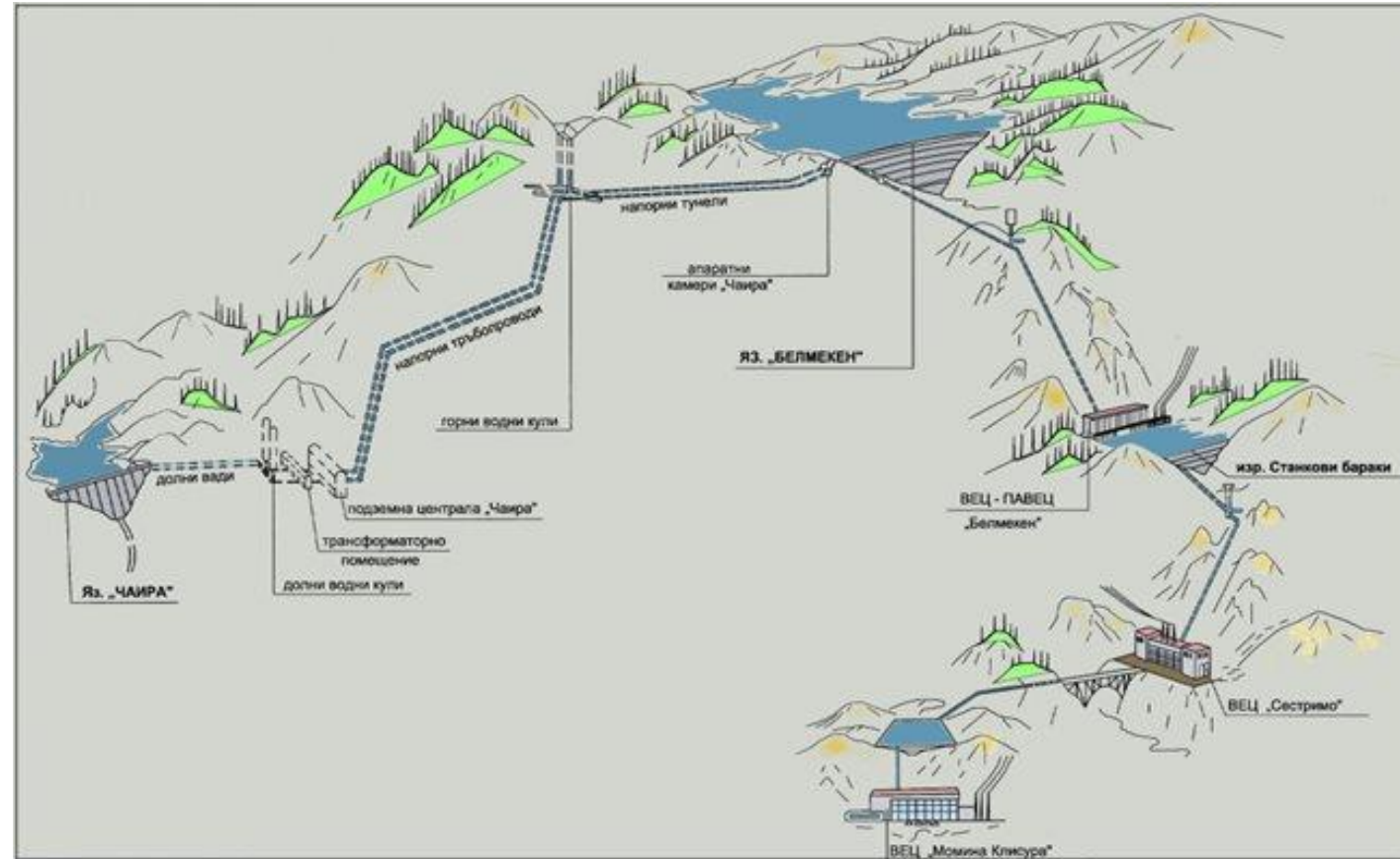
Type	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	Total
Wind (MW)	143	140	140	140	140	5	5	5	105	5	831
PV (MW)	3243	2136	2937	1968	2795	302	308	302	302	492	14785
HPP (MW)	6	0	2	0		0	0	0	800	800	1608
Biomass PP (MW)	1	2	27	2	2	2	2	2	8	2	49
Hybrid PP (MW)	5	0	0	151	100	0	0	0	0	0	256
Total	3398	2278	3106	2261	3037	309	315	309	1215	1299	17529

Source: TYNDP 2024-2033

Pumped storage

National Electricity Company (NEK) owns and operates a pumped storage fleet which includes:

- **PSHPP Chaira** - 4 x 216 MW in generation mode and 4 x 196MW in pumping mode;
- **PSHPP Belmeken** - 5 x 75 MW in generation mode and 2 x 52 MW in pumping mode;
- **PSHPP Orfey** - 4 x 40 MW in generation mode and 1 x 45 MW in pumping mode.



Source: <https://t.ly/ze1Y6>

Chaira PSHPP accident - 23.3.2022

// ЕНЕРГЕТИКА

Тежка авария в ПАВЕЦ "Чаура" блокира централата за месеци

През февруари Бойко Рашков обяви, че се води проверка за ремонта на водната каскада за 25 млн. лв.








“A serious accident occurred today at the state-owned Chaira Nuclear Power Plant. According to information from "Capital", during testing of one of the turbines, which were under repair, a strong water hammer occurred and the facility was literally destroyed. The damage is such that repairs could hardly be made and it will probably be necessary to completely rebuild the power plant. As a possible reason, sources from "Capital" point to the lack of adequate computer simulations and unprofessional execution of the repair activities.” Source: Capital



Article

Investigation and Identification of the Causes of the Unprecedented Accident at the “Chaira” Pumped Hydroelectric Energy Storage

Georgi Todorov , Ivan Kralov, Konstantin Kamberov , Yavor Sofronov , Blagovest Zlatev  and Evtim Zahariev 

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Abstract: The present study deals with an accident analysis of the “Chaira” Bulgaria high-pressure Pumped Hydroelectric Energy Storage (PHES), especially the failures of the Francis large-scale Hydraulic Unit No. 4 (HU4). The causes of overloading and cracking of the stay vanes and their functionality are investigated. Despite many studies on the behavior of the runner and its safe operation, the complete destruction of the system due to the stay vanes failure has not been sufficiently studied and published in the scientific literature. The aim is to assess the reasons that have led to this unprecedented accident of the “Chaira” PHES of the total destruction of the stay vanes. Based on the historical data and the operating modes, as well as on the identification of the critical elements, an objective assessment of the risks of damage of the stay vanes and of the entire unit is proposed. A virtual prototype is built for the simulation of the system behavior in working and emergency conditions. The loads, stresses, and deformations are precisely calculated. The critical elements of the highly-loaded blocks are evaluated. Low-cycle material fatigue is with a high degree of confidence the dominant reason for the stay vanes complete destruction. The results of the research are used to propose measures for the possible rehabilitation and/or replacement of the unit.



Citation: Todorov, G.; Kralov, I.

Pumped storage - Outlook

“The repaired hydropower unit of the Chaira Hydroelectric Power Plant is about to undergo tests for launch in early 2025.” (Mediapool, 24 October 2024)

“No applicants: The second attempt to repair the Chaira PSHPP also failed” (Actualno, 20 November 2024)

*“NEK raised the price of another order for hydro units for the Chaira Hydroelectric Power Plant”
(Mediapool, 17 December 2024)*



Image: NEK

Policy framework - NECP

No specific goal for BESS apart from recognition of the importance of energy storage

Proposed measures:

- Increasing the operational potential of the Chaira PSHPP with construction of the Yadenitsa Dam
- Construction of the Dospat and Batak pumped storage hydroelectric power plants;
- Approximately 200 million euros in investments in frequency regulation batteries, the total capacity of which is about 180 MW
- Approximately 200 million EUR investments to encourage the combination of new renewables with local electricity storage facilities (totaling around 200 MW);
- Transformation of AES Galabovo into a large-scale energy storage facility using proven technology implemented in concentrated solar power plants (CSP) using molten salts

Legislation related to BESS

DEFINITION

- Energy Act - Section IV, Art. 90 (SG No. 11/2023)

CONSTRUCTION

- Spatial Planning Act
- Industrial batteries are defined as movable objects within the meaning of the

CONNECTION

- Ordinance N° 6 (SG No 28/2024)
- Grid code simplified procedure for producers/consumers - with notification and annex to the access contract (if the capacity at the connection point is not changed)
- No double network fees: access and transmission prices are paid only for the difference between the amount of electricity purchased from electricity market participants and the amount of electricity returned to the relevant network

LICENSING

- RES/storage projects up to 20 MW do not require a license for electricity production

OPERATION

- Ordinance N° 9 of 9.06.2004 on the technical operation of power plants and networks
- Ordinance N° 3 of 9.06.2004 on the design of electrical installations and power lines

Incentive scheme - RESTORE

PARAMETERS

- Target: Achieve 3000 MWh in BESS capacity to enhance the balancing of the electricity system
- Incentive: The maximum grant intensity is 50% of the allowed costs, but not more than appx. EUR 185,000 per 1 MWh
- Max capacity per project: 600 MWh
- Max grant per project: EUR 75,999,488.71 in grant support
- Commissioning: Before 31 March 2026

ELIGIBILITY REQUIREMENTS

- A seat within the European economic zone;
- Secured a 3% bid bond calculated on the requested grant amount;
- Equity of more than BGN 6m for BESS between 20 MWh and 50 MWh and BGN 10m for BESS above 50 MWh;
- Budgets for each of several predefined categories.

TECHNICAL REQUIREMENTS

- Request for a minimum capacity of 10MWac;
- Have a technical advisor with previous experience in either a combined project for production and storage or standalone storage project with capacity of at least 20 MW;
- Have storage time of more than two hours;
- Comply with the parameters for securing reserves for primal regulation of the frequency and/or automatic secondary regulation of the frequency and power;
- Have a BESS design

Incentive scheme – RESTORE results

- Initial results announced on 6 December 2024
- 151 proposals were submitted
- Total proposed project budget nearly BGN 5 (EUR 2.55) billion.
- Grants requested BGN 1.154 (EUR 0.59) billion .



РЕПУБЛИКА БЪЛГАРИЯ
Министерство на енергетиката

BESS in practice: Project examples



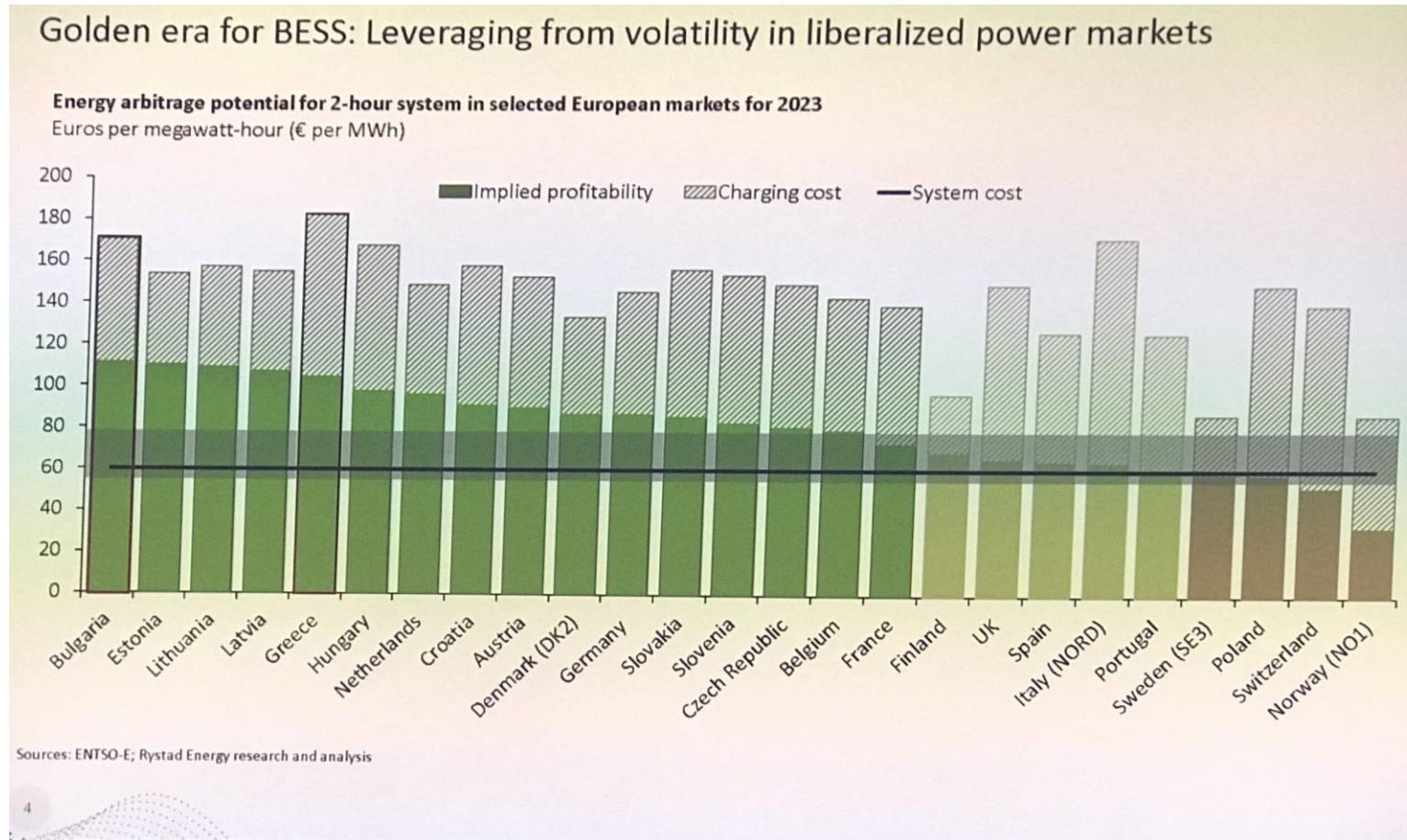
Owner:	Investo Partners (Renalfa IPP)
Capacity	25MW/55MWh collocated with a 33MWp PV plant
Equipment	Hithium, Kehua



Owner:	Solaris Holding (Sunotec and Eurohold)
Capacity	??MW/61-MWh collocated with a 32MWp PV plant
Equipment	Huawei Technologies

Images: Renalfa, Solaris Holding

BESS Outlook



Source: Rystad energy

Feedback / Questions?



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